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## RECENT GEOLOGIC CHANGES AS AFFECTING THEORIES OF MAN'S DEVELOPMENT

By G. FREDERICK WRIGHT

The questions of the antiquity of man and of the origin of the races of mankind are largely dependent for their solutions on the date and character of recent geological events. The forces on which the evolution of mankind is dependent are too vague to afford any definite light either on the antiquity of man or on the date of the origin of the various races into which he was separated before the dawn of history ; for the rate in the development of a species is directly dependent on the rate of the changes in the physical environment which preserves and accumulates the advantageous variations. It is a truism that prolonged uniformity of conditions will secure the prolonged life of a species or variety of plant or animal. The study, therefore, of geological changes is one of utmost importance for the biological evolutionist.

The Tertiary period was, for the greater part, one of comparatively permanent physical conditions, and likewise of comparative permanence of its animal species. For example, in central Europe numerous species of hyenas, rhinoceroses, and antelopes, and the great *Machairodus*, continued from Miocene all through the Pliocene into post-Pliocene times ; while hippopotami and elephants continued through a good part of the Pliocene period, and in America rhinoceroses and camels ranged through both Miocene and Pliocene times. But all these and many more species became suddenly extinct in the brief post-Pliocene period, which was marked by the rapid accumulation and disappearance of the great ice-sheets of the Glacial epoch.

Evidence that the existence of man antedates the close of the Glacial epoch has continued to accumulate until few would now venture to question the reality of Glacial man. Positive evidence is now produced from Babylonia and central Asia, carrying a pretty high state of civilization 7,000 or 8,000 years before the Christian

era. At the same time geological investigations are accumulating evidence which brings the closing stages of the Glacial period down to 5,000 or 6,000 years before the Christian era. There can, for instance, be little reasonable doubt that glacial ice lingered over the Mohawk valley in central New York and over the lower St Lawrence valley so as to obstruct the drainage of the Great Lakes in that direction and turn it over into the Mississippi valley as late as 8,000 years ago; so that the discovery of human implements and skeletons in glacial deposits is no more startling than are the discoveries of the progress in human civilization made by the explorations in Babylonia. The Glacial epoch overlapped the human epoch to an indefinite extent; while the acknowledged recency of the close of the Glacial epoch makes it unsafe to draw any sweeping conclusions antagonistic to the evidence of Glacial man from his high state of advancement in certain arts, such as drawing and sculpture, and from the high development of his skull, for the positive evidence in Egypt and Babylonia reveals races of men and of domestic animals of highly developed varieties which were doubtless contemporaries with Glacial man in Europe and America. The negroid characteristics appear upon the earliest Egyptian monuments, while the Semitic and Turanian characteristics appear in the earliest ruins of Babylonia.

It is altogether probable that the races of mankind were all developed with great rapidity in the comparatively brief prehistoric period included in the Glacial epoch, and that the latter was itself a prominent factor in promoting and fixing those variations. This theory has been brought out with great force by Professor Raphael Pumpelly in his presidential address before the Geological Society of America in 1906, in which he maintains that the oases of central Asia have been favorable places for the isolation and rapid development of early races through their relation to the varying glacial conditions that have influenced them. From numerous lines of evidence it appears that the glaciers on the mountains of central Asia have had repeated cycles of increase and diminution resulting in corresponding increase and diminution in the size of the streams that irrigate the oases about their bases, and causing variations in the size of the lakes occupying the inclosed basins of the region.

It is precisely such changes in physical conditions that would most directly and rapidly affect the development of races of mankind in both their physical and mental characteristics. Necessity is the mother of invention, and the necessity of constant readjustment to these conditions would be the spur leading to that great range of discoveries which form so important a part of the life of mankind even in these later days. We fail to realize adequately the significance of the fact that nearly all our domestic plants and animals were developed by man and adapted to his purposes during this prehistoric period. It was in prehistoric times that all the essential principles of agriculture were discovered and the arts of spinning and weaving and housebuilding invented. Once discovered, these arts have served the human race with little change for 10,000 years. But it seems altogether likely that at the beginning they were made with a rapidity corresponding to that which through recent discoveries has transformed the whole face of civilization in the last hundred years.

In America the positive evidence of Glacial man has been collected from two rather widely separated epochs, namely, the Iowan and the Wisconsin period. The remains of man in the Iowan period have been found in the loess of the Missouri valley. Mr Gilder's discovery of human relics in the loess near Omaha, Nebraska, would seem to be so confirmatory of the evidence from Lansing, Kansas, that there could be no longer reasonable ground for doubting the Glacial age of the Lansing man, since the deposits of loess in the two places are substantially synchronous. At the same time it gives renewed importance to various earlier reported discoveries of implements in the loess of this period. One ground for rejecting the evidence of these discoveries has been the advanced character both of the implements and of the skulls.

This objection to the evidence has been given increased weight from the fact that the implements found at Trenton, New Jersey, and at Little Falls, Minnesota, which belong to the later Wisconsin stage of glaciation, are of a ruder type, indicating a more primitive stage of culture than appears in the earlier implements of the Iowan stage. But the differences in age need be only a few thousand years, and we are by no means compelled to suppose that the one

race was descended from the other, since the variation in the extent of glacial ice was a most potent factor effecting the migrations of early races or even their extermination. We have but to suppose these racial differentiations to have been substantially the same 10,000 years ago as they are now, as is actually shown by the discoveries in Egypt and Babylonia, to see how the migrations caused by the vicissitudes of the Glacial epoch could bring the relics of different degrees of culture into close contact with each other in geological depositions that were separated by long periods. The lapse of time since the Iowan stage of the Glacial epoch is very likely so small, as compared with the preceding period of man's existence, that we need not look for any great changes in his physical structure to have occurred since that epoch. In short, with our present knowledge of the recency of the Glacial epoch and the rapid change of conditions affecting man which it brought about, we are left very much in the dark concerning the influences that most affected the rate of the progress and development of primitive man.

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